

### **REMARKS/ARGUMENTS**

The outstanding Final Office Action rejects claims 1-17 and 21-26 on various grounds and over various applied references.

As a beginning comment, the Applicants respectfully submit that because new grounds of rejection are offered as to unamended claims 8 and 9, the finality of the pending Office Action is probably improper. Accordingly, the Applicants request that the holding of finality be withdrawn as to this Action. Applicants' fuller explanation of this assertion follows in the body of this response.

In response to the Final Action dated April 27, 2006, the following Amendments to the Claims are made. Claims 1, 2, 5, 17-20 and 24 are cancelled herein. Claim 8 is amended to correct a typographical error. Claims 3, 4, 6, 7, 10-16 and 21 are also amended. Claim 9 remains unamended. Claims 27-28 have been newly added. The various ground of rejections are discussed below. Claims 3, 4, 6-16, 21-23 and 25-28 are now pending in this application.

### **IMPROPER HOLDING OF FINALITY**

Under the guidance set forth in MPEP 706.07(a), a Rejection may be made final on a second action "except where the examiner introduces a new ground of rejection that is neither necessitated by applicants amendment of the claims nor based on information submitted in an information disclosure statement". Here the pending action has introduced a new ground of rejection as to claims 8-9, not necessitated by applicant's amendment of these claims.

The Applicants respectfully submit that the current Final Rejection is improper because new grounds for rejecting Claims 8 and 9 have been made. Claim 7 (upon which 8 and 9 depend) was amended in the previous Action to obtain independent form (i.e., all base and intermediate limitations were incorporated). No other changes to Claim 7 were made. Moreover, no amendments to Claims 8 and 9 were made. Accordingly, Claims 8 and 9 remain unamended.

Claims 8 and 9 were previously rejected on three separate grounds: under 35 U.S.C. § 102(e) in view of *Bonkabeta et al.* (US Pat Pub 2004/0188260 hereinafter "*Bonkabeta*"; under 35 U.S.C. § 103(a) by *Bonkabeta* in view of *Taylor* (US Pat Pub 2003/0178315 hereinafter

"Taylor"); and under 35 U.S.C. § 103(a) by *Taylor* in view of *Zhou et al.* (USPN 6,402,931 hereinafter "*Zhou*").

**Each of these grounds is expressly withdrawn at page 2 of the pending action.**

Additionally and critically, new grounds of rejecting these claims are now made in the pending Action. Accordingly, the Applicants respectfully submit that that the Action's assertion of these new grounds of rejection (of unamended claims) makes the finality of the instant rejection improper. Consequently, the Applicants request that the finality of the pending rejection be withdrawn.

Additionally, the Applicants respectfully request entry of the amendments made herein. Also, the Applicants respectfully request reconsideration of the application based on the amendments and remarks made herein. Also, a new Office Action is respectfully requested.

### **GENERAL COMMENTS CONCERNING THE CLAIM REJECTIONS**

As before, a general comment is that, none of the cited art has any appreciation of the problem solved by the invention. Moreover, none of the cited art (nor any reasonable combination of art) solves the problem. None of the cited art has discovered or disclosed any appreciation of the "inverse" dishing metal layer profiles that are so problematic in modern polishing. Additionally, the cited art obtains an old style dishing profile after planarization. Thus, the cited art does not even address the basic planarization dishing problems inherent in the art.

This is the problem identified in the invention (See, e.g., Fig. 2 and the discussions pertaining thereto). A comparison of any of the dishing profiles in any of the cited art shows a standard dishing profile (i.e., overpolishing in the middle to create textbook dishing). This is especially prevalent in the core reference *Bonkabeta et al.* (US Pat Pub 2004/0188260 hereinafter "*Bonkabeta*"). A textbook prior art failing is depicted in claimed *Bonkabeta* invention as shown in Fig. 4. The Applicants point out that the dishing in Fig. 4 (near  $\Delta d_2$ ) of *Bonkabeta* is a classic case of a dishing profile avoided by the claimed invention. Thus, it can fairly be said that the cited art does not teach a solution to the underlying problem. Accordingly, the prior art invention is inoperative as to solving the problem at hand.

Additionally, all the cited art acknowledges that the dishing profile (e.g., in Fig. 4) is a problem and has not provided any solution. Moreover, all approaches set forth in the cited art freely acknowledge that the problem lies with excess overpolishing in the center of the metallized trenches (See, e.g., *Bonkabeta* Fig. 4) leaving healthy metallization built up at the edges of the trenches. Such is not the case with the claimed invention.

### Rejection Under 35 U.S.C. § 102

Claim 7 has been rejected under 35 U.S.C. § 102(b) as being anticipated by *Bonkabeta*.

Claim 7 has been amended to clarify certain aspects of the invention and hereby traverse the pending anticipation rejection.

As to amended Claim 7, the Applicants respectfully traverse this rejection on the following grounds:

Claim 7 includes an operation of "removing the excess portions of the metal layer by performing sequentially electropolishing followed by electroplating, *wherein the polishing, plating, and relaxation operations comprise one cycle of a pass*". And also, the cited art fails to teach the equilibration step described in more detail below. As stated in the prior action, the Applicants again assert that a "relaxation operation" is not set forth in the cited art in sufficient detail to enable one of ordinary skill to practice the claimed invention. Accordingly, *Bonkabeta* fails to establish a *prima facie* case of anticipation.

Additionally, if such a relaxation operation has been taught in the cited art, the action has failed to indicate where. As to Claim 7, the Office Action has failed to point out the relevant teachings of the prior art relied upon with reference to the column and line numbers (See, MPEP 706.02(i)(A)). Also, the Examiner is invited to shown any portion of the text where a relaxation step is taught.

However, in an effort to clarify the importance of this operation in the Examiner's mind, Claim 7 has now been amended to recite that "the relaxation operation is performed in a manner enabling the organic additive concentration to achieve local equilibrium before a next cycle begins". This limitation is supported at numerous places in the Specification. For example, reference is made to page 14:ll. 9-13 or p. 17: ll. 5-8 and elsewhere. This is important because

the relative concentrations of the additives in the regions local to the surface affect the relative polishing/plating rates and thereby affect the final profile of the surface. This is well explained and in great detail throughout the Specification.

More importantly, this aspect of the invention is not described or anticipated (or even suggested) by the cited art. In fact, the cited art does not anticipate or even understand there is a problem, what the problem is, or what possible solutions are. Absent such teachings in the cited art it cannot support an anticipation rejection. Accordingly, the cited art is insufficient to establish a valid anticipation rejection. Clearly there are no teachings in the art of a relaxation operation sufficient to equilibrate the additive concentration in a region local to the features being planarized (i.e., in the regions above the trench/via structures). Absent this limitation, the cited art does not teach all limitations of Claim 7 and is therefore unable to anticipate Claim 7. Accordingly, because the cited art fails to teach all claim elements of the claimed invention, the cited art does not establish a *prima facie* case for anticipation and is therefore insufficient to establish a rejection under 35 U.S.C. § 102. Therefore, the Applicants respectfully request that this ground of rejection be withdrawn as to Claim 7. This reasoning also applies to all claims depending from Claim 7 (particularly to Claims 8 and 9).

#### Rejections Under 35 U.S.C. § 103

Claims 1-4, 6, 8, 9, 16 and 21-26 stand rejected under 35 U. S. C. §§ 103(a) as being unpatentable over *Bonkabeta*.

As to Claims 1, 2 and 24, these claims have been cancelled making further discussion of such claims moot. Accordingly, the Applicants request that this rejection be withdrawn as to Claims 1, 2 and 24.

Claims 3, 4, 6, 8, 9, and 16 also stand rejected under 35 U. S. C. §§ 103(a) as being unpatentable over *Bonkabeta*. Applicants respectfully traverse the remaining rejections as discussed below. Significantly, Claims 3, 4, 6 and 16 are now amended to depend from base Claim 7 discussed above. It is also pointed out that Claims 8 and 9 were already dependent from Claim 7. Additionally, Applicants have already pointed out the deficiencies of the *Bonkabeta* reference as to base Claim 7. Nothing additional provided by the added cited portions of *Bonkabeta* correct the deficiencies raised above.

Again, as asserted above, with respect to Claim 7 above, the cited art has not shown a relaxation time, and more particularly, has not shown or suggested a "relaxation operation ... performed in a manner enabling the organic additive concentration to achieve local equilibrium before a next cycle begins" as recited in Claim 7. This shortcoming of the cited art is believed to be dispositive of the cited references.

It is for at least these reasons that the cited art fails as an effective 103 reference. However, each of the dependent claims has a number of independently patentable features which will be discussed briefly.

For example, in Claim 9 recites "ratio of the electropolishing to plating rates in the first of the at least two passes is about 1.5 and the ratio of the of the electropolishing to electroplating rates in the last of the at least two passes is about 1, wherein the electropolishing to electroplating rates progressively decreases from the first to the last of the at least two passes." This progressive reduction in polish/plating ratio is not taught or suggested in the cited art. There is no indication in *Bonkabeta* or the state of the art in general to support that this gradual reduction results in the truly excellent polishing profile obtained by the claimed invention. Again, the *Bonkabeta* process results in a profile with excess dishing (See, Fig. 4). To the extent this gradual reduction is obvious, the cited references and the state of the art do not support such a conclusion. Thus, as to Claim 9, the Office Action has failed to point out the relevant teachings of the prior art relied upon with reference to the column and line numbers (See, MPEP 706.02(j)(A)). To the extent a skilled man would be aware that the gradual change in the ratio would provide the advantageous profile, the Examiner is also invited to provide a reference supporting that assertion (See, MPEP 706.02(j)(et seq.)).

As to Claim 21, the cited art fails to teach or suggest a "relaxation operation being conducted in a manner enabling the organic additive concentration to achieve local equilibrium before a next cycle begins". Quite frankly, *Bonkabeta* is a much more primitive invention having no real appreciation of the effects of the relaxation period or its likely effect on the final contour of the polished surface. This is again no more convincingly shown than in the idealized profile shown in *Bonkabeta* at Fig. 4 which clearly shows just the effect the invention is designed to avoid (dishing).

Further, as to Claim 21, the cited art fails to teach or suggest "the electropolishing being conducted such that that localized polishing rates inside the trenches at the corners of the

trenches are greater than the localized polishing rates in the middle of the trenches resulting in a metal removal profile that removes metal at greater rate at the corner of the trenches relative to a metal removal rate in the middle of the trenches" as recited in Claim 21. In fact, *Bonkabeta* teaches precisely the opposite of this (See, *Bonkabeta*, Fig 4). Similarly, the cited art also fails to teach or suggest "electroplating being conducted such that localized plating rates inside the trenches at the corners of the trenches are greater than the localized plating rates in the middle of the trenches resulting in a metal deposition profile having a thicker metal layer at the corner of the trenches relative to the metal layer in the middle of the trenches". Again, *Bonkabeta* teaches precisely the opposite of this (See, *Bonkabeta*, Fig 4). The previous Action has made light of this by asserting that routine experimentation may have obtained these remarkable results. Routine experimentation produces exactly the opposite results. *Bonkabeta* is the product of routine experimentation and it produced the opposite.

So, *Bonkabeta* has failed to teach or suggest all of the claimed elements and has also failed to show how the claimed invention is obvious in view of the teachings of *Bonkabeta*. Accordingly, on these two grounds, the cited art has failed to establish a *prima facie* case of obviousness as the Claims 7 and 21 (and also all claims depending therefrom). Therefore, the applicants respectfully submit that the cited references are insufficient to establish that the claimed invention is obvious. Accordingly, Applicants respectfully request that the pending ground of rejection be withdrawn.

Claims 5 and 17 stand rejected under 35 U. S. C. §§ 103(a) as being unpatentable over *Bonkabeta* in view of *Taylor*.

Applicants respectfully submit that, due to the cancellation of these claims, the underlying point of these rejections is now moot. Accordingly, Applicants respectfully request that this ground of rejection be withdrawn.

Claims 10-14 stand rejected under 35 U. S. C. §§ 103(a) as being unpatentable over *Bonkabeta* in view of *Reid*.

Applicants respectfully traverse this rejection as well. Applicants have already pointed out the deficiencies of the *Bonkabeta* reference as to amended base Claim 7. Nothing additional provided by the added cited portions of *Reid* corrects the deficiencies of *Bonkabeta*.

As to Claims 10-14, the Applicants respectfully traverse this rejection on the following grounds. The cited art does not teach or suggest "relaxation operation is performed in a manner enabling the organic additive concentration to achieve local equilibrium before a next cycle begins". Such a relaxation is not taught by *Bonkabeta* nor is it taught in *Reid*.

Additionally, the Applicants point out that *Reid* does not address the issue of surface planarization at all. The *Reid* reference is directed to a plating process, not a planarization of an existing deposited layer. Thus, its parameters are of no relevance. There is no motivation to combine a standard deposition process with the *Bonkabeta* reference to teach a planarization process. Additionally, in the last action the Examiner failed to address this argument and merely restated his arguments without supporting their challenged validity. The Applicants respectfully request that the Patent Office more clearly explain this rejection in view of the arguments raised.

Additionally, the combination of additives together in the unique ranges specified (See, especially Claims 13 and 14) produces the surprisingly advantageous final profile achieved with the present invention. This is not spoken of nor suggested by any of the cited art. In fact, the prior art resultant profile teaches away from the corner mended profile achieved in accordance with the principles of the invention.

Thus, the cited combination of references fails to teach all limitations of the invention and fails to provide a valid motivation to combine the references. Accordingly, because the cited art fails to teach all claim elements of the claimed invention, the cited art does not establish a *prima facie* case for obviousness. Moreover, the cited references fail to provide a valid motivation to combine *Bonkabeta* with *Reid* and are therefore insufficient to establish a rejection under 35 U.S.C. § 103. Therefore, the Applicants respectfully request that this ground of rejection be withdrawn as to Claims 10-14.

Claim 15 is rejected under 35 U. S. C. §§ 103(a) as being unpatentable over *Bonkabeta* in view of *Datta*. Applicants respectfully traverse this rejection as well. Applicants have already pointed out the deficiencies of the *Bonkabeta* reference as to amended base Claim 7 upon which Claim 15 now depends. Nothing additional provided by the added cited portions of *Datta* correct the fundamental deficiencies of *Bonkabeta*. For example, neither *Bonkabeta* nor *Datta* teach or suggest "the relaxation operation is performed in a manner enabling the organic additive concentration to achieve local equilibrium before a next cycle begins". This is not taught by *Bonkabeta* nor is it taught in *Datta*. Thus, the cited combination of references fails to teach all

claim elements of the claimed invention and therefore does not establish a *prima facie* case for obviousness. Therefore, the Applicants respectfully request that this ground of rejection be withdrawn as to Claim 15.

**New Claims:**

Claims 27-28 have been added to specifically clarify certain patentable subject matter.

In one representative example, Claim 27 recites numerous features not suggested by the cited art. For example, Claim 27 recites "executing a series of cycles for removing the excess portions of the metal layer wherein said cycles include performing sequentially electropolishing followed by electroplating and equilibrating the electrolyte plating solution wherein the equilibration is performed in a manner enabling the organic additive concentration to achieve local equilibrium before a next cycle begins", a feature not taught or suggested in the cited art. Also, Claim 28 recites a method "wherein said equilibrating of the electrolyte plating solution comprises locally equilibrating the electrolyte plating solution near the metal later on the trench or via being planarized, said equilibration taking into consideration the diffusion coefficients for the additives".

Moreover, the underlying art is believed to be insufficient to establish rejections of the new claims for the additional reasons discussed above with respect to the other claims.

**Conclusion:**

In view of the foregoing amendments and remarks, it is respectfully submitted that the claimed invention as presently presented is patentable over the art of record and that this case is now in condition for allowance.

Accordingly, the Applicants request withdrawal of all pending rejections and request reconsideration of the pending application and prompt passage to issuance. As an aside, the Applicants clarify that any lack of response to any of the issues raised by the Examiner is not an admission by the Applicants as to the accuracy of the Examiner's assertions with respect to such issues. Accordingly, Applicants specifically reserve the right to respond to such issues at a later time during the prosecution of the present application, should such a need arise.

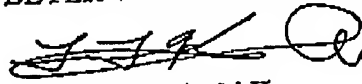


As always, the Examiner is cordially invited to telephone the Applicants' representative to discuss any matters pertaining to this case. Should the Examiner wish to contact the undersigned for any reason, the telephone number set out below can be used.

Additionally, if any fees are due in connection with the filing of this Amendment, the Commissioner is authorized to deduct such fees from Deposit Account No. 12-2252 (Order No. 03-1498).

Respectfully submitted,

BEYER WEAVER & THOMAS, LLP



Francis T. Kalinski II  
Registration No. 44,177

P.O. Box 70250  
Oakland, CA 94612-0250  
Telephone: (650) 961-8300